

Technology Development Project Melrose

STATEMENT OF OBJECTIVES

1.0 Scope of Work

The objective of this work is to obtain the most advanced micro optic array technology available for use as features in United States (US) currency. The desired products will be new features suitable for use in protecting the next generation of US currency from counterfeiting threats and to provide the general public with a user friendly feature with which to quickly and confidently validate notes passed in common, everyday transactions. The focus of this work is the technology development effort of achieving security feature exemplar advancement by the Contractor(s) within the scope of concept (Phase 1) and feasibility (Phase 2) contract. Due to the complexity of the materials in development and the potential for multiple successful paths, it is possible and desirable that multiple discrete features will be realized from these efforts. It is the desire of the BEP to hold periodic technology reviews on the development effort's outputs in order to identify those specific technologies which are in a sufficiently advanced development state as to warrant promotion to the Product Development work stream. The following technical requirements direct the vendor on objectives to achieving the goals for this project. The goal of this work is for the vendor to develop fully functioning optical features adhering to the performance objectives outline herein and to present to the BEP and its stakeholders feature exemplars incorporated into or onto a substrate.

2.0 Referenced Documents

- A.** Non-Disclosure Agreement (NDA), latest version
- B.** Security Designation Guide (SDG), latest version
- C.** Test methods for light-fastness (ASTM G155, Table X3.1 Cycle 11)
- D.** Chemical Resistance Test (BEP STM 300.003)
- E.** Laundry Test (BEP STM 300.002)
- F.** EHS Requirements for Purchased Materials (BEP Document 75D-07.0-05)
- G.** Restricted Materials at DCF (BEP Document 75D-07.0-07)

3.0 Contractor Tasks/Requirements

All work and information shall be handled in accordance with the requirements of the NDA and the SDG. The Contractor shall propose a plan to address all requirements as described in this section (Section 3). The Contractor shall perform technology development on security feature concepts and shall deliver the resulting materials and any equipment necessary for evaluation and validation of the materials' performance to the BEP. The development work will be implemented using a periodic review approach that will allow the project to address the needs of the US Currency Program (USCP) for both the short and long term.

3.1 Develop concepts for overt, human-interpretive security features with the following characteristics and means of interrogation:

3.1.1 Optical concept characteristics – Each of the following shall be addressed in one or more of the development efforts. The BEP will prioritize which concepts will be pursued and to what extent using, in part, information provided by the contractor on the state of each concept. This prioritization may be rearranged, with concepts added or subtracted, as the development effort produces information on each concept.

- 3.1.1.1** Infinite axes activity: the feature displays activity when moved or tilted in any direction from the normal viewing angle. i.e., within a reasonable tilt angle cone, for a tilt in any direction from the axis perpendicular to the plane of the feature there are no “dead angles” at which the feature has no activity
- 3.1.1.2** High resolution images: the feature shall display image resolution greater than or equal to the current resolution per area available to the market for lens array based features. If at market, a plan for improving resolution shall be provided
- 3.1.1.3** High travel images: the feature displays images which move at least the entire dimension of the feature upon an inspection mode. An inspection mode here is a tilt from a normal viewing angle 90° to the plane of the feature to an oblique viewing angle
- 3.1.1.4** High contrast image: Feature shall contain line structures, pixels, or other patterns in portions that are optically recognizable compared to other portions of feature under a wide variety of environmental light conditions. The contrast must be visually improved over the currently deployed optical lens array features
- 3.1.1.5** Counter-motion moving image: Feature shall contain an image that moves in a direction perpendicular to the operation used in an inspection mode
- 3.1.1.6** Animated image: Feature contains images that flip, rotate, expand/contract, dive/surface or change color and/or tonality during an inspection activity
- 3.1.1.7** Appearing image: High contrast image revealed in a feature area only by using a specific operation of an inspection mode
- 3.1.1.8** Puzzle pieces: Feature exhibits some combination of high contrast images, image replacement, image completion, and hidden image of multiple icons that become a unified larger icon system when user performs multiple operations with multiple inspection modes
 - 3.1.1.8.1** Image replacement: Feature contains image that changes into a different image when user performs an operation under an inspection mode

- 3.1.1.8.2 Image completion: Feature contains image of an incomplete icon that becomes a complete icon when user performs an operation under an inspection mode
 - 3.1.1.9 Transmission contrast effects to be seen when viewing through the feature medium and any supporting substrate
 - 3.1.2 Develop concepts for deploying optical feature in different applications
 - 3.1.2.1 Thread
 - 3.1.2.2 Patch or surface application
 - 3.1.2.3 Window
 - 3.1.2.4 Embedded or partially embedded in the substrate
 - 3.1.3 Additional Concepts – The following concepts shall be addressed as possibilities for additional levels of functionality
 - 3.1.3.1 Device assisted: Feature displays a mode of visualization that is made apparent through the use of an activation device. The device may be a powered means of excitation or use non-powered interactions to assist with inspection. Microtext would be included in this category
 - 3.1.3.2 Forensic image: Feature contains characteristics that are not revealed under the normal inspection modes for public cash use, not revealed in public training literature, and not be obvious or recognizable as a distinguishing image for the feature. Nanotext would be included in this category
 - 3.1.3.3 Additional concepts related to advanced optical lens arrays
 - 3.1.4 Inspection modes and user operations
 - 3.1.4.1 Overt, reflected light: feature functionality shall be instantly observable to the general public cash user under normal lighting conditions and shall serve to attract user attention, be a viable verification option, and warrant closer inspection with another inspection mode
 - 3.1.4.2 Overt, Transmitted Light: feature functionality shall be observable to the general public cash user when viewing with transmitted light thru the banknote and be a viable verification option
 - 3.1.4.3 Overt, Angular Dependent Light: feature functionality shall be observable under normal or feature-specific lighting conditions and change in image and/or spectral response when user changes the angle of incident light and/or viewing angle(s)
 - 3.1.4.4 Overt, Rotational Dependent Light: feature functionality shall be observable under normal or feature-specific lighting conditions and change in image and/or spectral response when user rotates the feature within the same plane relative to the incident light and/or viewing angle(s)
 - 3.1.4.5 Device-Assisted Human-Interpretive: Feature can be validated by use of common, hand held assistance devices such as 365 nm UV excitation lamps or standard magnifiers

- [illegible]

3.4.3 Machine readable activity will be discussed with and approved by the BEP prior to implementation into feasibility assessments

3.5 Develop a quality plan

3.5.1 Develop a plan for ensuring quality is designed into the feature during the research and development stage

3.5.2 Develop a plan for ensuring feature quality is maintained during production

3.6 Identify alternative sources of supply for raw materials

4 Deliverables

4.1 Initial technology screening survey report – Perform survey and technology screening for novel optical effect technologies which demonstrate high complexity of color reflectance/ transmission and/or movement responses. Novel as used here could include, but not be limited to, new optical effects, previously identified technologies with advances in development, materials previously identified but exhibiting new optical effects or a new combination of effects that produces a previously unknown optical effect or response which is related to the technology being developed under this contract or for micro optics in general. The vendor shall provide a detailed summary of those novel optical effects as outlined below

4.1.1 Initial technology screening report with a technology matrix for ranking feature technologies

4.1.2 Updates to the report shall be made at least quarterly and may coincide with the quarterly technology summary

4.1.3 The BEP will direct the vendor to integrate any new optical effect technology from the matrix into the feature assembly to assess initial feasibility for a future development by adding the technology to the Desired concept characteristics list in section 3

4.2 Monthly progress checkpoints

4.2.1 Vendor reports

4.2.2 Vendor presentation/meeting

4.2.3 Conference call

4.3 Quarterly Technology Summaries/Exemplar review

4.3.1 Physical delivery and presentation of most advanced feature exemplars

4.3.2 Technology readiness (maturity)

4.3.3 Market sector evaluation

4.3.3.1 Updated technology screening report

4.3.4 Project development versus market assessment

4.3.5 Vendor summary

4.4 Annual project development summary

- 4.4.1 Physical delivery of most advanced feature exemplars
- 4.4.2 Presentation of project viability
- 4.4.3 Presentation to the BEP's stakeholders

5 Feature exemplars.

The feature exemplars for each technology will demonstrate the optimum feature functionality which is currently feasible with that display technology.

- 5.1 Exemplars shall be unique and not currently available for commercial use or being marketed to parties other than those of the USCP
- 5.2 Exemplars shall be constructed with the goal of obtaining the required concept characteristics from section 3.1
- 5.3 Exemplars shall show the effort towards addressing the non-optical properties described in 3.2, 3.3 and 3.4
- 5.4 Exemplars shall show the effort towards addressing the machine readable properties described in 3.5
- 5.5 For each exemplar, the Contractor shall supply a quantity of feature exemplar units suitable to demonstrate the intended properties for all functional modes developed. These units shall be in the base film technology form
- 5.6 Goal for the exemplars, following the ASTM G155, 72 hour exposure following Cycle 11 of Table X3.1, there shall be no delamination with the color and/or illumination response the same as prior to the test
- 5.7 Representative samples of each optical exemplar shall be incorporated into/onto a substrate and delivered as note-sized coupons
- 5.8 Goal for the exemplars, following the BEP STM 300.003 (Chemical Resistance Test), there shall be no delamination of the material
- 5.9 Goal for the exemplars, following the BEP STM 300.002 (Laundry Test), there shall be no delamination, but creasing of the films is allowed. The color and/or illumination response is the same as prior to the test between creases.
- 5.10 The Contractor shall work with the BEP to provide know-how and assistance in combating the potential counterfeiting of these security features made from commercially available materials
- 5.11 Periodic progress meetings will be scheduled by the BEP to discuss/review exemplars. Meeting location and format (such as, teleconference) will be mutually agreed upon by both parties.

6 Feature Selection.

Criteria for feature selection by the BEP will be based upon the exemplar's adherence to the requirements outlined in Section 3.

7 Milestones.

For each individual technology, material, effect response, and feature characteristic, the project process shall entail the following activities for technology development:

7.1 Concept Phase

7.1.1 Define current technology state

- 7.1.1.1** Provide optical theory of feature effect/functionality
- 7.1.1.2** Conduct market research of existing materials
- 7.1.1.3** Describe the current state of the market
- 7.1.1.4** Conduct market research on related application materials
- 7.1.1.5** Define research potential of the proposed features

7.1.2 Define technology ability to address:

- 7.1.2.1** Feature users
- 7.1.2.2** Feature inspection methods

7.1.3 Define feature concept criteria

7.1.4 Define a quality plan for feature R&D

7.1.5 Define a quality plan for feature production

7.1.6 Define feature selection/acceptance criteria

7.1.7 Define technology development scope & objectives

7.2 Feasibility Phase: Functionality

- 7.2.1** Exemplar demonstrating a specific feature functionality
- 7.2.2** Exemplar demonstrating multiple feature functionalities
- 7.2.3** Exemplar demonstrating a different version of feature
- 7.2.4** Basis of evolving feature over time and/or for denomination purposes

7.3 Feasibility Phase: Integration

- 7.3.1** Demonstration of effect materials in experimental test apparatus
- 7.3.2** Demonstration of effect materials with support/application media
- 7.3.3** Demonstration of effect materials as a feature applied to paper substrate
- 7.3.4** Demonstration of feature exemplar with thickness relevant to banknotes

7.4 Feasibility Phase: "Proof of Concept"

- 7.4.1** Feature exemplars with function and integration

7.5 Feasibility Phase: Initial Durability

- 7.5.1** "Proof of Concept" feature exemplars pass battery of durability tests

7.6 When a feature concept possesses exemplars which demonstrate "Proof of Concept" and Initial Durability, that feature concept has passed the Feasibility phase of technology development

7.7 Test and Optimization Phase: with completion of Feasibility phase requirements, feature concepts may move forward to the "Test & Optimization" phase of technology development upon the direction of the BEP, which may provide the additional requirements for that phase of technology development at that time

7.8 Project Pipeline

- 7.8.1** Feature concepts continue to populate the project pipeline as additional potential feature versions to address the future needs of the project with regards to alternate feature effects, alternate feature application methods, advanced feature versions, market relevance, technology maturity, banknote deployment strategy, and denomination stratification
- 7.8.2** Multiple feature prototype versions and/or alternate feature concept prototypes may be necessary to pass Feasibility requirements for the project as a whole to be considered to enter the “Test and Optimization” phase of technology development
- 7.8.3** Multiple feature prototype versions and/or alternate feature concept prototypes may continue to be in the Feasibility phase of development while other feature concepts have already entered the “Test and Optimization” phase of technology development